

Inadvertent injection of potassium chloride instead of sodium chloride during treatment of chronic low back ache with epidural injection leading to paraplegia

ABSTRACT

Epidural injection of steroid is given for back pain resistant to other conservative management. Normal saline (NS) is used as diluent in 80 mg methylprednisolone and a local anesthetic. Due to a similar looking ampoule of NS and potassium chloride (KCl), there is a probability of accidental use of KCl instead of NS. We present a case of a 50-year-old male patient having low back ache refractory to other conservative treatments. Epidural injection of steroid was given, but accidentally KCl was mixed with methylprednisolone instead of NS. He developed severe cramps in the lower limbs, pruritus, and sweating, and finally paraplegia. Electrocardiography and blood showed features suggestive of hyperkalemia. He was given calcium gluconate and potassium chelating agent along with supportive measures. The patient recovered within 8 h. It is concluded that calcium gluconate and potassium chelating agent can be used if accidentally KCl is injected in epidural space.

Key words: Epidural injection; low back pain; paraplegia; potassium chloride.

Introduction

Epidural steroid injections are commonly performed procedures in medicine by many specialties including orthopedics.^[1] Normal saline (NS) is used as diluent for steroid and local anesthetic agent.^[2] Inadvertent injection of potassium chloride (KCl) during anesthesia procedures is reported by many anesthesiologists;^[3-8] however, to the best of our knowledge, it has not been reported by orthopedic surgeons. Here, we report a case of paraplegia that developed after accidental use of KCl instead of NS as diluent along with methylprednisolone and local anesthetic. Injection was given through caudal route in the sacral hiatus. The purpose of this case report is to diagnose the case, to approach for its management, and to caution the beginner regarding its occurrence if utmost attention is not given before injecting a drug.

Case Report

A 50-year-old male patient presented to us with L5 nerve root radiculopathy, conservative managements such as nonsteroidal

anti-inflammatory drugs and physiotherapy after which epidural administration of 80 mg of methylprednisolone was planned. Our routine method of epidural injection is to take 80 mg of methylprednisolone and 2 ml of 2% lignocaine in 20 ml of syringe and to dilute it up to 20 ml using 0.9% NS. After aseptic preparation of the local site, the previously prepared solution was injected into the sacral hiatus using a 22-gauge needle. Immediately after injection, the patient started complaining of severe pain in both the lower limbs. Pain was associated with pruritus, severe cramps, and profuse sweating. Approximately

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over a period of 5 min, he developed progressive weakness of both the lower limbs. On further clinical examination, the patient had complete flaccid paraplegia below T11 level. Below T11, all the reflexes were absent. On further examination, his blood pressure was recorded as 210/110 mmHg and heart rate was 124 beats per minute.

The patient was shifted to medicine emergency immediately. For high blood pressure, labetalol was given immediately; however, patient's blood pressure was refractory to the treatment. Sweating and agitation continued. Electrocardiography showed features suggestive of hyperkalemia such as tachycardia, absent P-wave, and tall T-wave. We reviewed the medication administered and found that instead of NS, 15% KCl was used as diluents by a junior assistant by mistake. The patient was shifted to the Intensive Care Unit. All supportive measures were given. In addition to supportive measures, membrane stabilizing agent calcium gluconate was used. Blood samples showed normal studies, except raised potassium levels (7 mg/dL). Potassium chelating agent (Ksylate) was used to decrease potassium concentration in the blood. After 2 h of treatment, blood pressure and heart rate returned to normal levels. Return of sensory modalities occurred after 6 h, and by that time, the patient had developed spasticity. There was exaggeration of deep tendon reflexes and extensor plantar reflex. The patient became neurologically normal in the next 2 h. The patient was discharged the following day from the Intensive Care Unit.

Discussion

The sacral hiatus provides the most caudal and direct route of entry to the epidural space and allows for the administration of steroid-based solutions for the treatment of lumbar pathology. Advantages of the caudal approach are a dramatically decreased incidence of dural puncture.^[9]

KCl has often been confused with 0.9% NS because the two solutions have similar looking ampoules distinguished only by different colored writing.^[3,4]

Different concentration of KCl injection leads to almost similar spectrum of symptoms and with full recovery. Reports of permanent neurological deficits and death have also been reported.^[3-7] do Nascimento *et al.* had reported unintentional use of 19.1% KCl as diluents. The patient developed lower limbs warmth, increase heart rate, raised blood pressure, intense pruritus on the chest, agitation, increased sensory and motor blocks, and respiratory failure secondary because of pulmonary edema, and the patient required ventilatory support. The patient recovered totally after 24 h.^[3]

Tessler *et al.* reported that sufentanil 25 µm, meant for postoperative analgesia, was inadvertently diluted to 10 ml with 15% KCl instead of 0.9% NS and was then injected through an epidural catheter into the epidural space in the postoperative room. The patient developed sensory blockade to T1 spinal level and diaphoresis above this level. Sixty minutes later, she developed hypertension which responded well to hydralazine 10 mg and labetalol 25 mg intravenous (IV). The patient was treated supportively with oxygen. To reduce spinal cord edema, dexamethasone 10 mg IV was administered. The patient recovered completely within 12 h.^[4]

Liu *et al.* reported two patients who underwent thoracotomy for resection of pulmonary or esophageal carcinoma. Postoperatively, accidentally KCl was mixed with morphine and was injected through epidural catheters for pain management. The patient complains severe injection pain over the lower extremities or the abdomen, followed by progressive weakness and numbness over the lower extremities and lower abdomen, and subsequent respiratory difficulties. In addition to endotracheal intubation and ventilatory support, steroids were administered both IV and epidurally to suppress spinal cord irritation. Both the patients regained motor and sensory functions 14 and 18 h later, respectively, without any sequela.^[7]

Sometimes, KCl injection leads to neurological deficit for a few months. Shanker *et al.* had reported a case in which 11.1% of KCl was accidentally injected in epidural space. The patient recovered from paraplegia in 6 months.^[6]

Lin *et al.* had correlated different epidural KCl concentrations with temporary or permanent sensory and motor deficits.^[5] In their study, rats had been used as a study model, and hence, it cannot be applied for human.

Mechanism of development of symptoms has been proposed. It is tabulated in Table 1.

In most of the cases reported, the method of treatment is supportive. It took approximately more than 12 h to recover fully.^[3,4,7] In this case report, we used calcium gluconate and potassium binder along with supportive measures, and the patient recovered completely in 8 h.

Conclusion

Paraplegia after unintentional epidural administration of KCl is reversible more often than not if diagnosed early and treated immediately. The method of treatment is mostly supportive and symptomatic, but recovery can be enhanced with the use of membrane stabilizing agents and potassium

Table 1: Mechanism of symptoms observed in epidural injection of potassium chloride

Clinical picture	Mechanism
Pain and pruritus	Irritation of cell membrane due to hyperosmolar solution ^[8,9]
Neurological deficit	High extracellular concentration of potassium in the spinal canal ^[6]
Autonomic dysfunction	Cephalad diffusion of potassium in the cerebrospinal fluid leads to sympathetic stimulation because of rapid depolarization of sympathetic neurons ^[3,4,6,7]
Pulmonary edema	Histamine release ^[3,10]

binders. Our recommendation is to always read the ampoule information carefully before using any drug.

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Conflicts of interest

There are no conflicts of interest.

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